New Hampshire Climate Change Policy Task Force
Draft Action Reports under Development

Agriculture Forestry and Waste (AFW) Working Group

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AFW Action 1.1.1 – Increase Cover Crops

Summary

Cover crops should be promoted in agricultural activities. Soil carbon content and the capacity of soil to hold nitrogen can be increased by cultivating cover crops. Because of the increase in soil nitrogen, increasing the use of cover crops can also reduce the amount of fertilizer needed.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Planting cover crops at the end of the cropping season utilizes residual soil nitrogen. Winter rye, as an example, becomes established in cool fall weather, overwinters, and grows vigorously in early spring. The plants are then incorporated into the soil in late spring, building soil organic matter. Summer cover crops have the same benefit and can be planted during fallow periods in the growing season. The cover crops may also collect soil nitrogen and then release it as they break down rather than allow some of it to escape as the greenhouse gas nitrous oxide (N_2O) into the atmosphere. There may also be a reduced need for fertilizer application, which would reduce energy and greenhouse gas emissions indirectly.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order):* Education
    b. *Resources Required:* Funding for educational materials and outreach to farmers and farming communities; seed; additional labor and farm equipment.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Cost of seed, availability of labor.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
    a. *Parties Responsible for Implementation*: Cooperative Extension Service and its agents, the New Hampshire Department of Agriculture, Markets & Food, as well as individual farms and farmers.
    b. *Parties Paying for Implementation:* Potentially federal grants, state agencies, and farmers.
    c. *Parties Benefiting from Implementation:* Farmers would benefit from improved soil health, and citizens all would benefit from reduced CO_2 and N_2O emissions.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing:*
    b. *Proposed:* AFW Action 1.1.2 – Increase Conservation Tillage/No-Till Farming Practices
    AFW Action 1.1.3 – Protect Agricultural Land

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate

Program Evaluation

1. Estimated CO_2 Emission Reductions
    a. Short-term (2012): <0.01 MMTCO2e/year
    b. Mid-term (2025): <0.01 MMTCO2e/year
    c. Long-term (2050): <0.01 MMTCO2e/year

2. Economic Effects
    a. Costs
        i. Implementation Cost: Moderately Low
        ii. Timing: Constant / even
        iii. Impacts: Business – small
    b. Savings
        i. Potential Economic Benefits: Moderately low
        ii. Timing: Constant / even
        iii. Impacts: Business – small

3. Other Benefits/Impacts:
    a. *Environmental:* Cover drops help prevent wind and water erosion, and utilize nutrients that might run off to surface waters or leach to ground waters. Cover crops may also reduce the ability of weedy species to become established between plantings and can therefore reduce herbicide application rates.
    b. *Health:* Avoiding nutrient runoff can contribute to the maintenance of surface and groundwater water quality in nearby areas. Some nutrients, such as nitrates, can impact children's health.
    c. *Social:*
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*): This action has a high potential for implementation.
    a. *Technical:* There is an immediate potential for implementing this action as the technology is available and some farms are already engaged in these practices.
    b. *Economic:* There is an additional cost to farmers at a time when fuel prices are increasing on-farm costs; however, retaining nutrients in the soil may allow lower fertilizer applications on conventional farms, which would reduce costs.
    c. *Statutory/Regulatory:*
    d. *Social:*

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

AFW Action 1.1.2 – Increase Conservation Tillage/No-Till Farming Practices

Summary

There should be wider adoption of agricultural practices that reduce soil disruption and that can increase soil organic content through carbon deposition. Tillage/no-till farming can increase the total carbon content (stock) of soil and reduce the rate of carbon loss (flow) to the atmosphere through decomposition.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Conservation tillage/no-till farming minimizes soil disturbances and the release of soil nitrogen. This practice prevents the rapid loss of organic matter.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order):* Education
    b. *Resources Required:* Funding for educational materials and outreach to farmer and farming communities.
    c. *Barriers to Address (especially for medium to low feasibility actions)*

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
    a. *Parties Responsible for Implementation:* Cooperative extension and extension agents; the New Hampshire Department of Agriculture, Markets & Food; and individual farms and farmers.
    b. *Parties Paying for Implementation:* Potentially federal grants, state agencies, and farmers.
    c. *Parties Benefiting from Implementation:* Farmers would benefit from improved soil health, and all citizens would benefit from reduced CO_2 and N_2O emissions.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing*
    b. *Proposed:* AFW Action 1.1.1 – Increase Cover Crops
       AFW Action 1.1.3 – Protect Agricultural Land

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate

Program Evaluation

1. Estimated CO_2 Emission Reductions
    a. Short-term (2012): <0.01 MMTCO2e/year
    b. Mid-term (2025): <0.01 MMTCO2e/year
    c. Long-term (2050): <0.01 MMTCO2e/year

2. Economic Effects
    a. Costs
        i. Implementation Cost: Low

ii. Timing: Constant / even
iii. Impacted: Business – small

b. Savings

i. Potential Economic Benefits: Low
ii. Timing: Constant / even
iii. Impacted: Business – small

3. Other Benefits/Impacts

a. *Environmental:* Reduced tillage is less energy-intensive and requires less fuel. This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend. In addition it may also helps prevent wind and water erosion, and may lead to reduced nutrient runoff to surface waters or leach to ground waters.

a. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease. Avoiding nutrient runoff can contribute to the maintenance of surface and groundwater water quality in nearby areas. Some nutrients, such as nitrates, can impact children. The reduced fuel consumption can

b. *Social:*

c. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

a. *Technical:* There is an immediate potential for implementing this action as the technology is available and some farms are already engaged in these practices.

b. *Economic:* The reduced fuel use would come at a time when fuel prices are increasing on-farm costs. The reduced need to work the soil will result in direct cost savings. However, there may be an associated increase in the need to apply herbicides to control weedy species.

c. *Statutory/Regulatory:*

d. *Social:*

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

AFW Action 1.1.3 – Protect Agricultural Land

Summary

There should be a greater emphasis on preserving existing agricultural land. The conversion of agricultural land to developed land affects its carbon absorption capacity. New Hampshire should promote policies and practices that avoid releases of carbon stored in soils, preserve the carbon absorption capacity of existing agricultural lands, and enable continued carbon sequestration from the atmosphere. Available measures include acquiring and preserving open space, reducing sprawl through smart growth measures, and encouraging the reuse of existing infrastructure.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): When land is developed, the carbon that is stored in the soil is released into the atmosphere as carbon dioxide. Once land is developed, its potential to store carbon is significantly reduced as a result of the lower levels of biological activity occurring. Therefore, development contributes to climate change not only by releasing stored carbon into the atmosphere but also by reducing the capacity of soils to absorb CO2 from the atmosphere.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order):* Local, state, and federal conservation easement programs (dependent on appropriations from their governing bodies).
    b. *Resources Required:* Funding
    c. *Barriers to Address (especially for medium to low feasibility actions):* There may be competing land use demands in growing communities that may be seeking to increase their tax bases.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
    a. *Parties Responsible for Implementation:* Local, state, and federal governments, and non-profit organizations.
    b. *Parties Paying for Implementation:* Local, state, and federal government, and non-profit organizations.
    c. *Parties Benefiting from Implementation:* Farmers, farming communities, and the public at large benefit from the preservation of agricultural lands and other open spaces.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Local, state (LCHIP), federal and non-profit organizations are all involved in conservation easement programs that protect valuable farmlands from conversion to residential and commercial uses.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing:*
    b. *Proposed:* AFW Action 1.1.1 – Increase Cover Crops
       AFW Action 1.1.2 – Increase Conservation Tillage/No-Till Farming Practices

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate

Program Evaluation

1. Estimated CO_2 Emission Reductions: Action not individually quantified; included as part of TLU Land Use Actions.

2. Economic Effects
    a. Costs
        i. Implementation Cost: Moderately low
        ii. Timing: Constant / even
        iii. Impacts: Local government
    b. Savings
        i. Potential Economic Benefits: Moderately low
        ii. Timing: Low short-term / mostly long term
        iii. Impacts: Evenly distributed

3. Other Benefits/Impacts
    a. *Environmental*:
    b. *Health*:
    c. *Social*: Maintaining farmlands and other open spaces is a key component of many master plans in New Hampshire communities. To the extent that local farmland can be preserved and remain productive, we avoid greater dependence on foodstuffs imported from afar and avoid the environmental impacts associated with transporting food over long distances.
    d. *Other*:

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)
    a. *Technical*:
    b. *Economic*: Rising land values have made purchase of conservation easements relatively more expensive in recent years.
    c. *Statutory/Regulatory*:
    d. *Social*: Local, state, and federal conservation easement programs are dependent on the support of their governing bodies.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

AFW Action 1.2 – Avoid Forest Land Conversion

Summary

It is critical that we sustain the natural carbon sink provided by forests and their capacity to remove CO_2 from the atmosphere. Through photosynthesis, New Hampshire's forests take up the equivalent of 25 percent (EPA estimate) of the state's manmade CO_2 emissions annually. Minimizing forest land conversion to non-forested uses will be a key component of any successful emission reduction strategy. (Note that 20 percent of global manmade CO_2 emissions are caused by conversion of forest land to non-forested uses). Public policy objectives should include encouraging forest land owners to manage their forests sustainably for the dual purposes of producing forest products and maximizing carbon storage. New Hampshire has had considerable success in conserving large blocks of unfragmented forest land through perpetual easements – an important tool in maintaining the carbon sink that New Hampshire's forests presently provide and one which should be aggressively promoted in the presence of growing, competing land use pressures.

Program Description

1. Mechanism *(i.e., how the policy or program achieves the desired result)*
    a. Conservation Easements – Perpetual easements designed to prevent subdivision and development of land are and should continue to be a primary tool to conserve the carbon storage capacity of unmanaged and managed forests.
    b. Carbon Easements and Leases – The concept of acquiring a perpetual easement or a term lease for the primary purpose of securing the carbon storage capacity of forest land should be pilot tested to determine whether it should become a proactive public policy of the state.
    c. New Forest Management Strategies – The state should encourage forest land owners who manage their land for the production of forest products to voluntarily seek third party certification of their management practices and to consider adopting management practices that store more carbon than otherwise would be stored under a business-as-usual scenario (for example, by using longer rotations for harvesting); if enough landowners adopted certification and carbon storage management practices, it may be possible to increase the size of New Hampshire's natural carbon sink.
    d. Land Use Regulation – Municipal land use policies that encourage cluster development and discourage cookie cutter subdivisions reduce forest land conversion; the application of impact fees to minimize forest land conversion for development is one tool that may advance this objective.

2. Implementation Plan *(i.e., how to implement the specific policy or program)*
    a. Conservation Easements – Create a new state initiative through the Land and Community Heritage Investment Program to encourage large forest land owners to protect working forests and unmanaged forests with perpetual conservation easements; resources: new State dollars should be used to leverage non-state dollars to collaborate in attaining this goal; barriers: state capacity to commit funds and some resistance among larger landowners to perpetual easements
    b. Carbon Easements and Leases – Create a unit within LCHIP to test the marketability of leasing large blocks of forest land for their carbon storage capacity and the marketability of conservation easements with the primary objective of storing carbon; resources: additional staffing capacity at LCHIP and program dollars to invest in these instruments would be needed; program dollars for such work could come from revenues generated by the sale of carbon allowances under the Regional Greenhouse Gas Initiative as well as other carbon related taxes and fees; barriers: both carbon easements and carbon leases are ideas that have not been tested; society is used to getting the ecological service of carbon storage without having to pay for it.

c. New Forest Management Strategies – Encourage forest land owners that manage their land for forest products to adopt management strategies that increase the amount of carbon their forests store while continuing to manage the forest resource sustainably; resources: carbon leasing dollars could be targeted to those landowners willing to make such changes in resource management; barriers: forest land owners will insist that such an initiative be voluntary, which may be more of a limitation than a barrier.

d. Land Use Regulation – Provide municipalities with statutory incentives to adopt carbon friendly zoning ordinances, (for example) by enabling municipalities to charge impact fees on projects based on the net loss of forest carbon storage capacity; redevelopment of existing structures would pay no fee while projects consuming existing forest land would pay a relatively higher fee; resources: added staffing at the Governor's Office of Energy and Planning and at Regional Planning Commissions would be needed to supplement work already ongoing in this arena; barriers: absence of financial resources and resistance of the development community (practitioners and regulatory bodies).

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.)*

   a. Conservation Easements

      i. *Parties responsible for implementation*: LCHIP, NGO land trusts and municipal conservation commissions.

      ii. Par*ties paying for implementation:* Federal, state, and/or municipal taxpayers and private donors.

      iii. *Parties benefiting from implementation:* All New Hampshire citizens.

   b. Carbon Easements and Leases

      i. *Parties responsible for implementation:* LCHIP and NGO land trusts.

      ii. *Parties paying for implementation:* Consumers.

      iii. *Parties benefiting from implementation:* All New Hampshire citizens.

   c. New Forest Management Strategies

      i. *Parties responsible for implementation:* Owners of forest land, DRED/Division of Forest & Lands, NGOs with forestry related missions.

      ii. *Parties paying for implementation*: Owners of forest land and consumers of the forest products the lands produce.

      iii. *Parties benefiting from implementation:* All New Hampshire citizens.

   d. Land Use Regulation

      i. *Parties responsible for implementation:* Municipalities and regional planning commissions

      ii. *Parties paying for implementation:* Developers and consumers of new residential and commercial buildings and structures

      iii. *Parties benefiting from implementation:* All New Hampshire citizens

4. Related Existing Policies and Programs *(i.e., those that address similar issues without interacting)*

   a. Conservation Easements – LCHIP, municipalities, and NGO land trusts have existing capacity and resources (both presently limited by available dollars) to secure conservation easements on forest land

   b. Carbon Easements and Leases – There is no existing policy or program in place specifically targeted at this goal; the closest is the Current Use Program that reduces property tax liability for those who use land for forestry or agricultural purposes.

c. New Forest Management Strategies – In New Hampshire forest management practices are voluntary; many landowners use the publication *Good Forestry in the Granite State* (1998) as the standard for best management practices governing timber harvesting; *GFGS* presently has no guidance on forest management practices to sustain or grown carbon storage.

d. Land Use Regulation – Considerable effort is already underway to promote the use of cluster development for residential and commercial development of land, regulated largely at the local level.

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation)*

   a. Conservation Easements – Other than 4 above, none

   b. Carbon Easements and Leases – None

   c. New Forest Management Strategies – The Regional Greenhouse Gas Initiative (RGGI; EGU Action 2.2) is considering a policy change that would allow the regulated community to invest in offset projects, including forest management projects that meet the five goals for all offset projects: offsets must be *real, additional, verifiable, enforceable and permanent*. If adopted by RGGI and/or by a future federal cap and trade program), forest management offset projects that secure additional carbon reductions through forest management activities (like extended rotation) will likely provide a market to working forest land owners that does not exist today for storing additional carbon on their timber land.

   d. Land Use Regulation – Integrating the carbon storage values associated with avoiding forest land conversion would not be inconsistent with policies and programs already underway within many municipalities.

6. Timeframe for Implementation:

   a. Conservation Easements – Ongoing, with potential to grow with greater State appropriation of program dollars to accelerate forest land conservation

   b. Carbon Easements and Leases – A pilot project could be initiated today; any broader program would require new dollars and 18-24 months of program design and development to move forward.

   c. New Forest Management Strategies

      i. Voluntary practices that achieve additional carbon storage could be integrated into the update of *Good Forestry in the Granite State* currently underway, and frameworks for maximizing carbon storage could be in place within a year;

      ii. Owners of large blocks of timberland could be encouraged by the State to seek independent third party certification of their management practices, which assures sustainable management of the timber resource and sustainable capacity of the certified woodland to store carbon;

      iii. New Hampshire representatives on the RGGI steering committee should support the proposal to permit forest management offset projects, a proposal that will shortly be under active consideration by RGGI; successful implementation is contingent on competitive markets being available to invest in such projects;

      iv. Compensating land owners who increase their storage of carbon by implementing changes to their management practices with short term carbon leases (see b above) could be implemented upon the availability of dollars to invest in such leases.

   d. Land Use Regulation – Ongoing at municipalities and at RPCs; authority to enable carbon friendly impact fees may require amendments to existing state statutes.

7. Anticipated Timeframe of Outcome

   a. Conservation Easements – Immediate

b. Carbon Easements and Leases – Three years to pilot, develop and fund; benefits accrue as investments are made

c. New Forest Management Strategies – Benefits are cumulative; once management practice are implemented, the full benefits may be realized over a 100 year period

d. Land Use Regulation – Immediate if measured in forest conversion avoided

Program Evaluation

1. Estimated CO_2 Emission Reductions
    a. Short-term (2012): 1.66 MMTCO2e/year
    b. Mid-term (2025): 1.66 MMTCO2e/year
    c. Long-term (2050): 1.66 MMTCO2e/year

2. Economic Effects
    c. Costs
        i. Implementation Cost: Moderately high
        ii. Timing: Constant / even
        iii. Impacts: Local government
    d. Savings
        i. Potential Economic Benefits: Moderate
        ii. Timing: Low short-term / mostly long term
        iii. Impacts: Evenly distributed

3. Other Benefits/Impacts
    a. *Environmental*: Intact tracts are forest are better able to sustain biological diversity and healthy wildlife populations and play a role in the overall provision of ecosystem goods and services such as water supply provision.
    b. *Health*: Forests may also contribute to human health through beneficial impacts on air quality and mental health.
    c. *Social*: Sustainable backdrop for recreation and tourism industry. To the extent forested lands can be protected and remain productive, we increase the chance of maintaining the iconic character of our state and its natural resource industries in the long-term.
    d. *Economic*: Sustain the short and long term stable market for full range of forest products.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)
    a. *Technical*:
    b. *Economic*: Rising land values have made purchase of conservation easements relatively more expensive in recent years.
    c. *Statutory/Regulatory*:
    d. *Social*: Local, state and federal conservation easement programs are dependent on the support of their governing bodies.

5. Other Factors of Note:

6. Level of Group Interest: High

7. References:

AFW Action 1.3 – Promote Durable Wood Products

Summary

New Hampshire should create a program to develop a market for durable wood products. When wood is used to make products that have lasting value and are held for long periods of time, carbon is stored and not released into the atmosphere. Consumers often have a choice between a product made from petroleum or mineral base and one made from wood. The purchase decision is often formed around price and a short-term, throw-away mentality. An effective education campaign could be mounted to change consumer thinking that favors durable wood products over other materials when buying homes, building materials, furniture, and other accoutrements of modern living. Durable wood products are often more economical in the long run – if not initially – and, unlike petroleum- or mineral-based products, are environmentally sustainable. The proposed program would provide additional benefits to New Hampshire's economy while improving product manufacturing and transportation efficiency.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): State agencies collaboratively use their most effective outlets to educate the public on the values of choosing wood products. The message would also give the rationale to buy locally made products whenever possible.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
   a. *Method of Establishment (e.g., legislation, executive order):* The Governors Office would direct state agencies with the appropriate education departments or media contacts to coordinate develop and disseminate an effective educational campaign. This should include a monitoring effort to gauge the success of the campaign with an adjustment period if necessary.
   b. *Resources Required:* A set of facts and figures that the agencies can use to base their messages. These should be well researched and defendable if questioned.
   c. *Barriers to Address (especially for medium to low feasibility actions):* Barriers include other priorities that are already assigned to these agencies that have strong support from within or without and probable lack of additional, new funding to finance this effort.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
   a. *Parties Responsible for Implementation:* State agencies such as UNH Extension would be responsible. There are many small, industry, land owner and professional associations that would help but their resources are small and they could be perceived by the public as being biased.
   b. *Parties Paying for Implementation:* NH taxpayers, either as changed priorities or funded by the legislature, would pay.
   c. *Parties Benefiting from Implementation:* New Hampshire citizens and residents of the world would be the beneficiaries. The New Hampshire economy could benefit greatly if the program is successful and revitalizes the sawmilling industry in the state. It could encourage secondary manufacturing as well.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): The proposed action is somewhat related to "green labeling" of renewable products. That is, durable wood products are renewable. Even though they are long lasting and we expect to store carbon in them, when they are recycled back to the ecosystem they are essentially renewed and would be considered a "green" tag product.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)

a. *Existing:* Various Certification programs encourage stewardship plans that wood grow trees to financial maturity. Forest managed in this way will produce a higher percentage of quality, sawtimber which in turn would be used to produce durable wood products.

b. *Proposed:* Carbon cap-and-trade markets will encourage more conservative management strategies. These will result in maintaining higher stocking levels and longer rotations or cutting cycles. This will result in substantially higher yields of quality sawtimber and therefore durable wood products. Any success in "purchasing local" campaigns or in introducing secondary manufacturing for local markets can reduce transportation, therefore fuel used and carbon released.

6. Timeframe for Implementation: As soon as administratively possible. The wood using industry is currently depressed, affecting the entire New Hampshire economy. This effort would get the recovery started.

7. Anticipated Timeframe of Outcome: It could take up to a year for the effect of changes in consumer choices to reach back to saw mills. Helping to convince retailers to buy locally could have a much quicker effect.

Program Evaluation

1. Estimated CO_2 Emission Reductions

   a. Short-term (2012): 0.52 MMTCO2e/year
   b. Mid-term (2025): 0.52 MMTCO2e/year
   c. Long-term (2050): 0.52 MMTCO2e/year

2. Economic Effects

   a. Costs

      i. Implementation Cost: Low
      ii. Timing: Constant / even
      iii. Impacts: State government

   b. Savings

      i. Potential Economic Benefits: Moderate
      ii. Timing: Constant / even
      iii. Impacts: Business – evenly distributed

3. Other Benefits/Impacts

   a. *Environmental*: Land managed to yield higher amounts of durable wood products will have less visual impact and will be more compatible with other uses. Lesser amounts off fusel fuel are needed to make wood based products than similar petroleum or mineral based products. Durable wood products are less likely to end up in a landfill.

   b. *Health*: There are fewer toxic fumes released to the atmosphere in the production of durable wood products versus mineral or petroleum based alternatives.

   c. *Social*: Studies show that people have a warm feeling are calmer or more comfortable when associated with natural wood versus plastic, steel or concrete.

   d. *Other*: Wood is a renewable resource, which can be harvested to benefit the New Hampshire economy.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

   a. *Technical*: Most of the information is already developed.

   b. *Economic*: This could be a matter of establishing priorities for state employee's time or recognizing the potential value to the New Hampshire economy and budgeting funds to finance employees' time.

c. *Statutory/Regulatory*: Unless this is to receive special financing, nothing new would be needed.

d. *Social*: The time is right for this. Climate change is in the news every day, it is on peoples minds. People are already changing their behaviors in other ways.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

AFW Action 2.1 – Encourage the Use of Bioreactors for Landfills

Summary

Bioreactors should be evaluated as an alternative to conventional landfills in order to speed up the decomposition of solid waste and improve the recoverability of landfill gas (LFG) as an available fuel for space heating or power generation. The energy content in landfill gas is provided by methane (natural gas), which makes up about half of landfill gas at a typical municipal solid waste landfill. A bioreactor landfill facilitates the natural degradation of organic waste through the addition of liquid and (sometimes) air to enhance microbial processes. This concept differs from the traditional "dry tomb" landfill approach. Although bioreactor technology is not currently used at landfills in New Hampshire, a few of the state's landfills collect landfill gas and combust it to generate electricity. Of particular interest is the Turnkey Recycling and Environmental Enterprise landfill, located in Rochester and owned by Waste Management, Inc. This landfill, the largest in the state, has contracted to supply landfill gas to the University of New Hampshire in Durham to meet space heating needs and to power electrical generators. The state could seek to increase the number of landfill-gas-to-energy (LFGE) projects in the state through application of New Hampshire's Renewable Portfolio Standard and by engaging the PUC and NHDES to streamline project permitting and implementation. For landfills where LFGE is feasible, bioreactor technology might provide additional benefits.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): The anaerobic biological processes that take place in landfills generate methane (CH_4, a greenhouse gas), which has a global warming potential 20 times greater than that of CO_2. Often the methane is released into the air, or it is collected and burned off (flared) to reduce harmful emissions. But methane can also be collected and utilized as an alternative fuel to produce energy. The capture and use of methane prevents release of the gas to the environment and replaces energy derived from fossil fuels. Bioreactor technology does not alter the basic function of a landfill but serves to speed up the natural processes that cause the waste to decompose. In so doing, a bioreactor allows stabilization of the landfill material to occur sooner and may therefore improve the economic feasibility of energy production from collected gas.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order):* Federal and state laws to accomplish this are already in place. Federal rules exempt bioreactors from the normal ban on liquids in landfills and state rules allow it as well.
    b. *Resources Required:* Financial resources (moderate to significant) and engineering expertise are necessary.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Landfill bioreactors have not been proven on a wide scale, and technical questions remain. This technology might be appropriate for larger landfills, of which there are few in New Hampshire. For projects where landfill bioreactors are found to be feasible, there are likely to be infrastructure needs, including pipelines and electrical transmission lines.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
    a. *Parties Responsible for Implementation:* Decisions to implement energy recovery are made by the landfill owners.
    b. *Parties Paying for Implementation:* The landfill owners, either private or public, would be responsible for the capital expenses, although municipalities could allow private entities to capture methane from public landfills in exchange for fees and/or energy. Regulatory requirements already require that large landfills have active gas collection and control systems, so the energy recovery systems would be built upon what is already there.

c. *Parties Benefiting from Implementation:* Depending on the size of the project, the power might be used on site as an alternative fuel or sold for profit. In addition, the project might be eligible for renewable energy credits. If the investment is at a public facility, the taxpayers or ratepayers would benefit; if it is at a private facility, the company would benefit and might be able to pass along some of the savings to ratepayers. All citizens would benefit from collecting landfill gas to produce energy: Greenhouse gas emissions would be prevented and reliance on fossil fuels would be reduced.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Forty-seven percent of New Hampshire's waste is landfilled. Most of this waste is disposed of at a handful of large landfills, where there is significant potential for energy recovery and where, in a few cases, landfill gas is already collected and used for energy production.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

   a. *Existing:* DES has long advocated the flaring of methane to minimize its environmental impacts; the capture and use of methane makes the benefit two-fold because emissions are prevented and fossil fuels are replaced. Use of bioreactor technology would need to demonstrate compliance with federal and state landfill rules.

   b. *Proposed:*

6. Timeframe for Implementation: Other than the financial and engineering resources required to prepare, submit, process, and approve the necessary solid waste and air permit applications for bioreactor landfills, there are no constraints to implementation.

7. Anticipated Timeframe of Outcome: The additional collection of methane can begin as soon as a project is complete.

<u>Program Evaluation</u>

1. Estimated CO_2 Emission Reductions – ANALYSIS UNDERWAY

   a. Short-term (2012)
   b. Mid-term (2025)
   c. Long-term (2050)

2. Economic Effects

   a. Costs

      i. Implementation Cost: Moderately Low
      ii. Timing: Immediate / Higher upfront
      iii. Impacts: Business - Small

   b. Savings

      i. Potential Economic Benefits: Low
      ii. Timing: Constant / even
      iii. Impacts: Business – evenly distributed

3. Other Benefits/Impacts

   a. *Environmental*: Unmitigated release of landfill gas is unpleasant smelling and a potent contributor to greenhouse gas emissions. Capturing and combusting landfill gas is a way to control emissions by destroying methane and other harmful landfill gas components. Using the collected gas for energy encourages higher rates of capture and provides benefits as an alternative fuel.

   b. *Health*:

c. *Social*: Facilities that handle waste – even recycling facilities – are not popular among the residents of a town or neighborhood. A landfill that generates energy in addition to proper disposal of solid waste might be one step more acceptable to the public.

d. *Economic*: Capturing and using or selling methane is a way to maximize the significant investment in a landfill.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

   a. *Technical:* The technology for this application exists and is being used.

   b. Economic:

   c. Statutory/Regulatory:

   d. *Social:* Citizens who oppose landfills in general do not favor methane recovery because it favors continued use of landfills for waste disposal.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

AFW Action 2.2.1 – Maintain Infrastructure for Biomass Production and Support Regulatory and Business Efficiencies

Summary

New Hampshire should help to maintain its infrastructure for biomass production through policies that aid – or at least do not impede – forestry-related businesses in New Hampshire. The forest industry has long been one of the cornerstones of New Hampshire's economic health. Historically, pulp mills, sawmills, and the production of firewood for home heating have provided the logging industry in this state with diverse markets for their wood. However, New Hampshire has recently seen the loss of pulp and paper production in Berlin and Groveton, as well as a reduction in sawmill capacity for both hardwood and softwood mills. Relatively new markets, such as the production of electricity from wood chips (biomass) and the production of wood pellets for heating residential and public buildings, have provided needed markets for low-grade wood and have helped to strengthen existing logging infrastructure. Because these markets reduce New Hampshire's reliance on fossil fuels and our dependency on foreign energy supplies, they bolster the local economy while simultaneously reducing the state's carbon footprint.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): By limiting restrictive rules and regulations that would make producing forest products difficult, New Hampshire can help logging companies and related businesses to operate in an atmosphere conducive to success. Allowing state-regulated utilities to develop renewable biomass generation would provide additional markets for low-grade wood fiber.

   Relevant policies and actions may include, but are not limited to, the following:

   a. Maintain and upgrade E-2 bridges so that forest products may take the most direct route possible from stump to market.
   b. Restrict municipalities from enacting rules or regulations regarding forest harvesting over and above state regulations.
   c. Continue to support the certification of 100,000-pound loads for the transportation of forest products.
   d. Continue to support fair and equitable Workman's Compensation Insurance rates for the forest industry job classifications.
   e. Educate the general public as to the benefits of forest management.
   f. Promote forest management and harvesting on public lands.
   g. Continue to support the Baccalaureate and Associates Degrees Forestry Schools at the University of New Hampshire.
   h. Support work force training programs such as the Logger Certification Program.
   i. Allow state-regulated utilities to add renewable generation.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)

   a. *Method of Establishment (e.g., legislation, executive order)*: Through the careful monitoring of proposed rules and laws that would inhibit and/or otherwise restrict the harvesting of wood, the legislature would need to change existing law to allow state regulated utilities to add renewable generational assets.
   c. *Resources Required*: Some state monetary resources would be needed to maintain/upgrade E-2 bridge infrastructure.
   d. *Barriers to Address (especially for medium to low feasibility actions)*: Both local and state governing bodies would have to try to limit enacting legislation or rules restricting the harvesting, transportation of forest products.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
    a. *Parties Responsible for Implementation*: State government and municipal leaders.
    b. *Parties Paying for Implementation*: State government.
    c. *Parties Benefiting from Implementation*: The forest industry as a whole would benefit. Logging contractors would have less bureaucracy to deal with, as well as additional markets for low grade fiber, thus making them more efficient. Industries using forest products would benefit from a more efficient and cost effective wood supply infrastructure.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*)

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing*:
    b. *Proposed*:

6. Timeframe for Implementation: Each legislative session.

7. Anticipated Timeframe of Outcome: Businesses would benefit immediately after implementation.

Program Evaluation

1. Estimated CO_2 Emission Reductions
    a. Wood for Residential Heat
        i. Short-term (2012): 0.99 MMTCO2e/year
        ii. Mid-term (2025): 0.99 MMTCO2e/year
        iii. Long-term (2050): 0.99 MMTCO2e/year

    b. Wood for Electricity
        i. Short-term (2012): 0.42 MMTCO2e/year
        ii. Mid-term (2025): 0.42 MMTCO2e/year
        iii. Long-term (2050): 0.42 MMTCO2e/year

2. Economic Effects
    a. Costs
        i. Implementation Cost: Moderately low
        ii. Timing: Constant / even
        iii. Impacted: State Government
    b. Savings
        i. Potential Economic Benefits: Moderate
        ii. Timing: Constant / even
        iii. Impacted: Business – evenly distributed

3. Other Benefits/Impacts
    a. *Environmental*: There would be an increase in the health of forest stands and the associated improvements in wildlife habitat. This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our

ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.

b. *Health*: Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.

c. *Social*: Alternative generation technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.

d. *Economic*: Healthier forest products industry would in turn generate more economic activity for the state's economy.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

   a. *Technical*: There are no technical barriers to implementation.

   b. *Economic*: The proposed action would result in a significant increase in economic activity in all aspects of the forest industry.

   c. *Statutory/Regulatory*: The state should allow by statute all state regulated utilities to add renewable generation.

   d. *Social*:

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

AFW Action 2.2.2 – Ensure Biomass Consumption is within Sustainable Limits

Summary

New Hampshire's forested lands should be managed to sustainably provide forest products and energy resources over the long term. Forest biomass represents significant new opportunity to meet demands for both thermal and electric energy. However, biomass stocks to support this demand are not unlimited, and biomass is only one of many benefits we realize from our forests. Biomass consumption needs to be maintained within the biological capacity of the land to grow fiber; should not compromise biological diversity, water quality, recreational values and aesthetics; and should complement the existing forest products economy.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Understand the capacity of the forest to supply woody biomass across the landscape on a sustainable basis and support sustainable forest management for individual land ownerships. This would provide New Hampshire with a stable supply of energy over the long term as well as create a stable industry by ensuring a continuous supply of biomass.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)

    a. *Method of Establishment (e.g., legislation, executive order)*

        i. The New Hampshire Energy Facility Site Evaluation Committee permits bulk power facilities over 30 MW and should consider wood supply as a factor related to the orderly development of the region. Other legal or regulatory frameworks include the state's RPS, RGGI, and the interstate NEPOOL. None of these frameworks addresses thermal users or wood supply issues. Studies on wood availability are within the scope of state forestry agencies, the U.S. Forest Service, and several non-governmental entities.

        ii. Sustainable management of individual land ownerships can be promoted through independent third-party green certification of both public and private lands, with public lands setting an example and supporting the demand for certified products. In addition, sustainable management is promoted through Recommended Voluntary Forest Management Practices called for in state statute. Sustainable management can also be incorporated into the procurement practices of wood consumers such as those promoted through the Sustainable Forestry Initiative.

    b. *Resources Required:* Funds and data sufficient to prepare a comprehensive regional wood availability analysis. Funding to conduct independent third party green certification of state lands. Funding and administrative structures such as cooperatives to aggregate forest lands to be certified and to provide certified forest products.

    c. *Barriers to Address (especially for medium to low feasibility actions)*

        i. The reliance on the market place and individual project developers to conduct their own confidential due diligence around wood supply.

        ii. The lack of a regional approach to wood supply and forest management.

        iii. The unfair playing field created when requiring one wood consumer type to comply with standards when competing users do not have to comply.

        iv. The byproduct nature of wood biomass.

        v. The lack of understanding of and engagement in green certification programs by public and private landowners.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
    a. *Parties Responsible for Implementation*: Project developers, existing wood using facilities, public and private landowners.
    b. *Parties Paying for Implementation*: Not identified.
    c. *Parties Benefiting from Implementation*: Project developers, existing wood using facilities, public and private landowners who benefit from long term sustainable markets. Residents who live or visitors to forested portions of the state and public and private organizations whose mission is sustainable management of forests for a broad range of benefits.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Not fully identified. May include some items mentioned above.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing*:
    b. *Proposed*:

6. Timeframe for Implementation: Prior to broad expansion of biomass consumption.

7. Anticipated Timeframe of Outcome: In perpetuity.

Program Evaluation

1. Estimated CO_2 Emission Reductions
    a. Wood for Residential Heat
        i. Short-term (2012): 0.99 MMTCO2e/year
        ii. Mid-term (2025): 0.99 MMTCO2e/year
        iii. Long-term (2050): 0.99 MMTCO2e/year
    b. Wood for Electricity
        i. Short-term (2012): 0.42 MMTCO2e/year
        ii. Mid-term (2025): 0.42 MMTCO2e/year
        iii. Long-term (2050): 0.42 MMTCO2e/year

2. Economic Effects
    a. Costs
        i. Implementation Cost: Low
        ii. Timing: Constant/Even
        iii. Impacts: Government - State
    b. Savings
        i. Potential Economic Benefits: Supporting Mechanism
        ii. Timing:
        iii. Impacts: Business – evenly distributed

3. Other Benefits/Impacts
    a. *Environmental*: Intact tracts are forest are better able to sustain biological diversity and healthy wildlife populations and play a role in the overall provision of ecosystem goods and services such as water supply provision.
    b. *Health*: Forests may also contribute to human health through beneficial impacts on air quality and mental health.
    c. *Social*: Sustainable backdrop for recreation and tourism industry. To the extent forested lands can be protected and remain productive, we increase the chance of maintaining the iconic character of our state and its natural resource industries in the long-term.
    d. *Economic*: Sustain the short and long term stable market for full range of forest products.
4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)
    a. *Technical*: Potential data limitations.
    b. *Economic*: Costs of certification are not fully recovered in product sales.
    c. *Statutory/Regulatory*: Unknown
    d. *Social*: Identifying and supporting the threshold where renewable energy production and sustainable healthy forests are in balance.
5. Other Factors of Note:
6. Level of Group Interest:
7. References:

- Biomass Energy Resource Center, Northern Forest Biomass Energy Action Plan, 2007.
- NH Department of Resources and Economic Development, New Hampshire Forest Resources Plan, 2006.

AFW Action 2.2.3 – Ensure the Most Efficient Use of Energy/Biomass Stock

Summary

New Hampshire should develop plans to identify facilities that utilize biomass and encourage the most efficient use of the resource to reduce energy use and greenhouse gas emissions. The economics and supply of wood biomass for energy or thermal heat production are complex and have many important variables. Planners, producers, potential suppliers, marketers, investors, governments, regulators, and consumers need some understanding of these factors and the underlying resource data to make good decisions about the efficient use of the available resource. Low-grade wood material appropriate for power generation or thermal heat production is limited in availability, and its value is quickly diminished by the cost of transportation or distance it must be transported. Careful planning of the location of new, large consumers of biomass can help to preserve the efficiency of the industry.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*)

   In the current energy market, wood biomass is only affordable as a byproduct of harvesting higher-value materials. In other words, higher returns are needed from the sale of saw timber and pulpwood to finance some of the costs of harvesting low-grade, energy wood – primarily top wood, branches, saw mill waste, and other material not fit to make lumber or paper. The standards can vary depending on market conditions and hauling distances to the end points. The supply or availability of biomass can vary with demand for the other products. Growing conditions, soil productivity, tree species composition, and forest age varies throughout the state.

   This variation results in different potentials for supply of biomass from different areas. To address this situation, state agencies should develop information about wood supply potential and current market forces for the different areas of the state. This would include an analysis of transportation issues effecting delivery costs at marketing points.

   There is a higher efficiency of energy conversion from wood biomass to thermal heat than to electricity generation. Wood is grown and harvested in all communities in the state. There are opportunities to heat public complexes, buildings, private developments, individual homes, or even entire communities with wood biomass throughout the state. The public buildings or communities where biomass heating and cooling are a viable option should also be identified in order to exploit this energy resource most effectively.

   Some areas of the state where the wood supply is most abundant lack the electrical transmission line capacity necessary to locating wood-fired generation facilities there. Consequently, an assessment is needed of the physical limitations and other barriers to efficient development of electrical generation capacity using wood biomass as fuel.

   Existing wood-fired power plants produce "waste" heat that could support other heat-using industries. A promotion group could be contracted to find businesses needing an economic heat source and willing to relocate their operations adjacent to existing power generating facilities.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)

   a. *Method of Establishment (e.g., legislation, executive order)*: Additional funding and personnel would be required within existing agencies.

   b. *Resources Required:* The Division of Forests and Lands would need additional funding and personnel to modify and build on the Forest Service inventory of forest resources. Additional information would be needed to bring more accuracy to local levels and intent-to-cut permits should be monitored to keep the data base current. A data base of public buildings and schools already exists. It could be improved with a survey to determine the current age and type of heating and cooling system they have.

c. *Barriers to Address (especially for medium to low feasibility actions)*: There will be resistance to increasing budgets and staff. There could be a perception that this could take business from consultants who do this kind of work for individual firms or investors. Also, that making this information available to all, may take away some competitive advantage from some who have already developed that market.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
   a. *Parties Responsible for Implementation*: Developing a statewide forest resource and transportation base inventory is a large task with a lot of responsibility.
   b. *Parties Paying for Implementation*: It would require some investment by state tax payers.
   c. *Parties Benefiting from Implementation*: The greatest benefits would be to avoid making some big mistakes like over committing one resource base or not taking advantage of a readily available forest base that is currently under utilized or the products are of marginal value due to very long haul distances to market.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
   a. *Existing*:
   b. *Proposed*:

6. Timeframe for Implementation: It could take a year to fine-tune an inventory and data base that serves needs but doesn't cost more than required.

7. Anticipated Timeframe of Outcome: Once the inventory process is developed, it could take several years to build a reliable data base. Earliest user date would be 2011.

<u>Program Evaluation</u>

1. Estimated CO_2 Emission Reductions
   a. Wood for Residential Heat
      i. Short-term (2012): 0.99 MMTCO2e/year
      ii. Mid-term (2025): 0.99 MMTCO2e/year
      iii. Long-term (2050): 0.99 MMTCO2e/year
   b. Wood for Electricity
      i. Short-term (2012): 0.42 MMTCO2e/year
      ii. Mid-term (2025): 0.42 MMTCO2e/year
      iii. Long-term (2050): 0.42 MMTCO2e/year

2. Economic Effects
   a. Costs
      i. Implementation Cost: Low
      ii. Timing: Constant / even
      iii. Impacts: State government
   b. Savings
      i. Potential Economic Benefits: Supporting Mechanism
      ii. Timing:
      iii. Impacts: Business – evenly distributed

3. Other Benefits/Impacts

    a. *Environmental*: The proposed action would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems.

    b. *Health*: Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.

    c. *Social*: Alternative generation and energy efficiency technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.

    d. *Other*:

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

    a. *Technical*: May be difficult to plan, but once implemented, the issue of increasing energy efficiency and more appropriate biomass allocation becomes more feasible.

    b. *Economic*: It may be resource intense at first, but over the long term it can reduce the flow of energy dollars out of the state, and enable more energy dollars to flow into the state.

    c. *Statutory/Regulatory*: There may be existing statutes and policies that restrict the potential to utilize this resource in the short-term.

    d. *Social*: There should be wide public support as these efforts could lead to more jobs and greater energy and economic security at a time when prices are rising.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

AFW Action 2.3 – Increase Development and Use of Secondary Feedstocks for Biodiesel

Summary

New Hampshire should promote the research and development (R&D) and commercialization of biodiesel production in-state that relies on alternative, sustainable feedstocks such as yellow and brown grease and oil derived from algae. Up to now, the soy industry has been the driving force behind biodiesel commercialization because of product surpluses in the Midwest states and a decline in prices. Although a large portion of U.S. soybean oil is currently used for food purposes, the 20.4 billion pounds of oil cultivated in 2007 could have produced 2.65 billion gallons of biodiesel. Compared with the U.S. demand for distillate fuel of 62 billion gallons in 2006, the hypothetical use of all soy oil for fuel would amount only to 4.3 percent of demand. Furthermore, production of biodiesel from virgin vegetable oils on a large scale would be disruptive to global food markets. Unlike biodiesel based on vegetable oils, biodiesel produced from alternative, renewable resources could replace a greater portion of fossil fuels used for transportation and heating without adversely affecting food costs or supplies.

Program Description

1. Mechanism *(i.e., how the policy or program achieves the desired result):*

   Production of biodiesel domestically will reduce CO2 emissions through the displacement of fossil fuels used for home heating oil (HHO) and transportation fuels. Biodiesel does produce CO2 emissions when burned as fuel but is considered nearly carbon-neutral because CO2 is sequestered during the cultivation of the feedstock. However, a life-cycle analysis would show that biodiesel does release CO2 during harvesting, production, and distribution; and these processes should be considered when evaluating the overall carbon output of a feedstock option.

   Currently, the most common sources of oil for biodiesel production in the U.S. are soybean oil (80 percent of biodiesel feedstock) and yellow grease (primarily, recycled cooking oil from restaurants). Although the soy biodiesel industry has experienced tremendous growth in the past few years, the raw material needed for production is limited and creates a strain on commodities prices. Achieving the biodiesel industry's vision of replacing diesel demand at a price that is equivalent to or less than petroleum diesel calls for additional focus on alternative feedstocks for biodiesel production.

   Because of New Hampshire's seasonal climate and amount of agricultural land available, it is not feasible to grow soybeans or any other oilseed crop for mass biodiesel production within the state. However, yellow grease is one promising option for the state to take forward. Biodiesel can also be produced from brown grease, which is pan scrapings and washed oil residue that accumulate in grease traps under restaurant sinks. Brown grease is typically collected and treated at municipal wastewater treatment plants with anaerobic digestion, or it is accepted at landfills. In San Francisco, it was determined that there are more than 2.5 million gallons of brown grease, compared with 1.5 million gallons of yellow grease[1]. New Hampshire's demand for distillate fuels was 350 million gallons in 2006. Nearly 12 million lbs of yellow grease and 9.4 million lbs of brown grease are available in NH. If these were converted to biodiesel, the state could displace 1 percent of its distillate fuel use.

   Another potential feedstock, algae, has emerged as one of the most promising sources for biodiesel production for two main reasons: 1) the yields of oil from algae are substantially higher than those from traditional oilseed crops, potentially as much as 30 times more energy per acre than land crops like soybeans; and 2) algae can be grown on land separate from farmlands and forests, thus minimizing damage to those ecosystems and disruption to the global food market. There is a third interesting reason as well: Algae can be grown in sewage waters and next to power-plant smokestacks, where they thrive on CO2 and NOx emissions and produce up to 50 percent of their body weight in oil at a rate of 1,850(actual)-15,000(theoretical) gal/acre/year.[2]

2. Implementation Plan *(i.e., how to implement the specific policy or program):*

    a. *Method of Establishment*: Establish state policy by Executive Order for all restaurants to dedicate their waste grease to biofuel production.

    b. *Resources Required*: Changes in infrastructure will be necessary to produce and distribute biofuels. Pick-ups at restaurants will need to be coordinated through dedicated businesses or entities such as waste management. Research and development of algae technology is required.

    c. *Barriers to Address*: Permitting for biodiesel processing facilities due to fire codes (handling of methanol) and waste management (glycerin and contaminated water) has been an issue in New Hampshire in the past. Currently, the algae technology is not a well-established feedstock for biodiesel, although research has been underway since the 1970's, the process has not quite reached the level of commercialization.

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.):*

    a. *Parties Responsible for Implementation*: The state government will need to develop legislation that requires restaurants to collect and transfer their yellow and brown waste grease to appropriate entities. Permitting of the biodiesel production facilities will be necessary at the state level; including fire codes (due to methanol use in transesterification of biodiesel) and waste disposal (eg., glycerin, water) regulations.

    b. *Parties Paying for Implementation*: Processing infrastructure and research funding is required from the federal and state governments. Commercialization in NH will incur further capital and operational costs to build and maintain large algae greenhouse farms. Funding could come from capital investors, as is the case for many start-up algae companies already on track.

    c. *Parties Benefiting from Implementation*: Small businesses that produce and distribute biofuels now and in the future, as well as citizens who will benefit from a cost-effective means of producing large amounts of biofuel for transportation and home heating. State and municipal governments, privately-owned businesses, and large corporations will all benefit greatly by a reduced, stable cost of fuel.

4. Related Existing Policies and Programs (i.e., those that address similar issues without interacting): ASTM D6751 provides the specifications for pure biodiesel. In December 2007, ASTM passed its specification D6751-06a for 6-20% biodiesel. Senate Bill 522 has been passed by both the NH House of Representatives and Senate that will require that all biodiesel sold in the state meet the ASTM D6751 fuel quality standard by January 1, 2009.

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*

    a. *Existing:* House Bill 1631-FN was established by legislators in NH this year. This bill requires the DOT and the Division of Plant and Property Management to purchase fuels containing a certain percentage of biodiesel. Also in NH, the recycling of yellow grease is regulated under NH Code Administrative Rules Env-Sw 100-2100 (Solid Waste Rules, www.des.n h.gov/rules/desadmin_list.htm#solid). Processed waste vegetable oil has been certified as a waste-derived product by DES and can be used as a substitute for No. 6 oil or as a feedstock for the manufacture of biodiesel (see www.des.nh.gov/sw/waste_derived.htm).

    b. *Proposed*: AFW 1.2 – Avoid Forest Land Conversion
    TLU 1.C.1 – Adopt a Low-Carbon Fuel Standard
    TLU 1.C.3 – Install Retrofits to Reduce Black Carbon Emissions
    GLA 4.1.2 – Increase Use of Cleaner Fuels and Advanced Technologies
    GLA 4.2.1 – Reduce Diesel Particulate Emissions through Use of Retrofit Devices

6. Timeframe for Implementation: In the case of yellow and brown grease, implementation can take place as soon as collection fleets are organized and processing facilities are built. Research on cultivation and harvesting of algae is still emerging.

7. Anticipated Timeframe of Outcome: 1-5 years for waste grease collection infrastructure and biodiesel processing plants, 10-20 years for algae production facilities.

Program Evaluation

1. Estimated CO_2 Emission Reductions – ANALYSIS UNDERWAY

    a. Short-term (2012): On a volumetric basis, biodiesel generates 6 to 8 percent less energy per gallon than petroleum diesel, meaning more biodiesel by volume than diesel fuel is necessary to power a vehicle the same distance. Despite its lower energy content, biodiesel reduces carbon dioxide emissions compared to diesel fuel. A 1998 study sponsored by the U.S. DOE and USDA found that pure biodiesel (B100) used in urban transit buses reduced net CO_2 emissions by 78 percent compared with petroleum diesel.

    b. Mid-term (2025):

    c. Long-term (2050):

2. Economic Effects - ANALYSIS UNDERWAY

    a. Costs
        i. Short-term (2012):
        ii. Mid-term (2025):
        iii. Long-term (2050):

    b. Savings

        i. Short-term (2012):
        ii. Mid-term (2025):
        iii. Long-term (2050):

3. Other Benefits/Impacts

    a. *Environmental*: Biodiesel significantly cuts harmful environmental emissions. Use of biodiesel reduces greenhouse gas emissions of carbon dioxide, hydrocarbon emissions that contribute to the formation of ground level ozone, and carbon monoxide, a poisonous gas associated with fuel combustion.

    b. *Health*: Biodiesel is the only alternative fuel to have fully completed the health effects testing requirements of the 1990 Clean Air Act Amendments, and it is registered with the U.S. EPA as a motor fuel legal for sale and distribution. Use of biodiesel reduces particulate matter emissions that are associated with major health impacts, including cancer.

    c. *Social*: In addition to the environmental and health benefits of the fuel, biodiesel also helps reduce the country's dependence on foreign oil imports (fuel security), increase liquid fuel diversity, dampen petroleum price spikes, and create local jobs. Notably, with feedstocks such as yellow/brown grease and algae, New Hampshire will gain a local biodiesel supply.

    d. *Other*: Using yellow and brown grease provides a beneficial re-use of a material that might otherwise be disposed in landfills or be shipped elsewhere for biodiesel production.

4. Potential for Implementation *(i.e., including challenges, obstacles and opportunities)*

    a. *Technical*: Technical issues for converting waste greases into biodiesel are due to high percentages of free fatty acids (FFA) that require refining before transesterification of the oil with an alcohol and catalyst into biodiesel. Other methods are available, such as caustic stripping, acid esterification, and glycerolosis[5]. Research is still necessary in scaling up the technology of growing algae with high oil content for biodiesel production.

    b. *Economic*: Biodiesel promotes greater energy independence and boosts the domestic economy. Waste grease from restaurants and septage appear to be growing in economic value. San Francisco will begin to retrieve yellow grease from area restaurants and transfer it to a processing facility where it will be turned into biodiesel. This new arrangement is a win-win for both parties. The city provides the pick-up service free of charge to the restaurants, while securing for itself essentially cost-free feedstock for biodiesel production for use in its municipal fleet. Algae-based R&D is thriving, particularly for companies funded by capital investors.

    c. *Statutory/Regulatory*: Updated fire codes and waste regulations will need to be developed for biodiesel production facilities.

    d. *Social*:

5. Other Factors of Note: A project is proposed, yet remains unfunded, at the University of New Hampshire to grow algae for biodiesel using landfill gas (pure CO_2 is stripped from landfill gas, CH_4 is sent to UNH for energy cogeneration) and leachate at the Waste Management of New Hampshire site in Rochester. Notably, biodiesel production capacity is estimated to be 1.7 million gallons per year from a full scale facility with existing resources (CO_2 is limiting factor).

6. Level of Group Interest:

7. References:

- 1. San Francisco to build the first City Grease to Biodiesel Plant, May 29, 2008, http://www.nbc11.com/news/16426862/detail.html.
- 2. Journey to Forever, http://journeytoforever.org/biodiesel_yield.html.
- NHDES Environmental Factsheet. Environmental Permitting, Regulations and Other Requirements Related to the Manufacture of Biodiesel, CO-16, 2008, http://www.des.state.nh.us/factsheets/co/co-16.htm.
- New Hampshire Department of Environmental Services, Compliance Status on Municipal Responsibility for Septage Disposal, November 1, 2007.
- K. Shaine Tyson, Brown Grease Feedstocks for Biodiesel, NREL, June 19, 2002. http://www.nrbp.org/pdfs/pub32.pdf.
- G. Wiltsee, Urban Waste Grease Resource Assessment, publication no. NREL/SR-570-26141, available from the National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, Colorado 80401-3393.
- Biofuels Digest, Biotech Research boosts algae production rate by 34 percent with new micronutrient blend, May 23, 2008, http://biofuelsdigest.com/blog2/2008/05/23/biotech-research-boosts-algae-prodcution-rate-by-34-percent-with-new-micronutrient-blend-sending-samples-to-labs-universities-for-testing-on-more-algae-strains/.

AFW Action 2.4 – Encourage the Use of Biogenic Waste Sources for Energy Generation

Summary

The state should create and implement innovative programs to encourage the development of facilities and processes that utilize biogenic waste streams as energy sources and reduce New Hampshire's reliance on fossil fuels. These wastes can be generated in municipal, residential, agricultural, institutional, and industrial settings and can provide heat, power, and fuel through a number of applications. The potential wastes include sludge, septage, municipal and industrial wastewater, brown grease, residential and institutional food waste, leaf and yard waste, and manure.

Because of the impacts that a variety of factors can have on determining the most economical and efficient uses of waste streams for energy, the state should create a flexible program that would enable the most appropriate applications to be selected and developed. These projects could be incentivized in two ways: 1) by creating a loan program to assist livestock and industrial operations, and 2) by modifying existing municipal funding mechanisms to cover the higher initial capital costs of these projects, which would be offset by long-term reductions in operating costs and fossil fuel consumption. Additional resources could be developed to facilitate the optimization of the selected processes and achieve peak efficiencies.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): The state would develop the resources required to promote and invest in opportunities to manage New Hampshire's solid waste and wastewater streams while generating heat, electricity, and fuel (e.g., landfill gas, pellets). These projects could include:
    - Anaerobic digesters, which provide a means to treat large volumes of organic municipal, industrial and livestock wastes in an energy-efficient and cost-effective manner while generating methane (CH_4). The digesters decompose manure and other organic material from residential, commercial, and institutional settings in a controlled environment and recover the methane produced in the oxygen-free environment. The methane captured can then be used to create electricity, steam, heat, and fuel for vehicles to offset fossil fuel use and its associated CO_2 and black carbon emissions.
    - Microbial fuel cells that utilize manure and landfill leachate and other liquids with high biological oxygen demand (BOD) or chemical oxygen demand or (COD) to electrical potentials.
    - The direct conversion of organic wastes to fuel. The waste could be dried and pelletized or converted to other forms and then used to generate electricity or heat. It could be incinerated alone or combined with coal and burned to capture the renewable energy it contains.

    A loan program could be established to provide funding for specific sectors of the economy. For municipal waste water treatment plants, a policy change would be needed to make grants and funding available for these facilities to upgrade to anaerobic treatment facilities because of the higher initial costs. Existing policies dictate that funds be used to pay for the lowest-cost facility and technology option rather than accounting for the operating costs associated with the facility over its useful life.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order)*: Legislation and policy modifications
    b. *Resources Required*: Funding for the manure methane and industrial digesters loans and grants for municipal applications and support for further research into new technologies.
    c. *Barriers to Address (especially for medium to low feasibility actions)*: Digesters and other applicable technologies may have a higher first cost associated with them that will need to be addressed. Economy of scale: not all wastewater treatment facilities, industries or farms generate enough residuals to make the capital costs worthwhile or economically feasible (see 4a). Regionalization may be an appropriate concept to encourage in some segments of the state.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
    a. *Parties Responsible for Implementation*: New Hampshire state government, municipalities
    b. *Parties Paying for Implementation*: New Hampshire state government, municipalities, tax-payers, federal grant funds, livestock farmers and industrial facilities.
    c. *Parties Benefiting from Implementation*: Livestock farmers, municipal governments, tax-payers, industrial facilities.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing:*
    b. *Proposed:* AFW Action 2.1 – Encourage the Use of Bioreactors for Landfills
    AFW Action 2.3 – Increase Development and Use of Secondary Feedstocks for Biodiesel

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Short- to mid-term, based on the time required to site and permit new facilities.

<u>Program Evaluation</u>

1. Estimated CO_2 Emission Reductions – ANALYSIS UNDERWAY
    a. Short-term (2012):
    b. Mid-term (2025):
    c. Long-term (2050):

2. Economic Effects
    a. Costs:
        i. Short-term (2012):
        ii. Mid-term (2025):
        iii. Long-term (2050):
    b. Savings
        i. Short-term (2012):
        ii. Mid-term (2025):
        iii. Long-term (2050):

3. Other Benefits/Impacts
    a. *Environmental*: Anaerobic digesters reduce foul odor and can reduce the risk of ground- and surface-water pollution from manure and the volume of residual material that may need to be landfilled. The ash and biosolids that are left following the extraction of the energy can be used as a source of fertilizer and reduce the need for fossil fuel based fertilizers while also replenishing valuable micronutrients.
    b. *Health*: Improved air and water quality translates to better health and quality of life in the affected areas.
    c. *Social*: Alternative generation and energy efficiency technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to

long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.

d. *Other*:

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

   a. *Technical*: The anaerobic digester technology exists to be deployed immediately. The size of the dairy farms in the state may require special consideration when designing and operating an anaerobic digester, but could be addressed through the development of cooperatives.

   b. *Economic*: Digesters are often more expensive to install but are more cost effective to operate over the life of the facility. The cost to separate organics from the solid waste stream for biogas production could be prohibitive at first, but as energy prices continue to rise, it will likely be more cost effective.

   c. *Statutory/Regulatory*: Existing funding requirements may prevent the funding of aerobic digesters due to their higher capital costs.

   d. *Social*:

5. Other Factors of Note:

   New Hampshire is deficient in disposal capacity to address all of the septage and brown grease waste generated in the state. Municipalities are required under state statute (RSA 485-A:5-b) to provide or assure access to proper septage disposal for their residents. In addition, providing low- or no-cost disposal for brown grease will assist municipalities in managing this material properly. EPA suggests that the poor management of brown grease/grease trap waste (nationally) is the #1 cause of sanitary sewer overflows, which degrade the environment and pose a significant threat to public health.

6. Level of Group Interest: High

7. References:

- Biogas fuels city buses, garbage trucks, taxi cabs, even a train in Sweden, http://www.exchangemagazine.com/morningpost/2008/week27/Thursday/070304.html.

AFW Action 3.1 – Implement a Pay-As-You-Throw Initiative (PAYT)

Summary

Pay-as-you-throw (PAYT) programs should be promoted for municipalities as a way to address waste generation and improve recycling rates. A substantial portion of the solid waste stream is composed of materials having significant embodied energy content, and many materials can be recycled or reused. The fraction of the waste stream that can be recycled or reused can displace the emissions associated with producing new materials from virgin raw materials. The current recycling rate in New Hampshire is less than 21 percent, well below the national average of 32 percent. There are a number of potential strategies that can be applied to improve the state's recycling rate, but one that has already proven successful in a number of New Hampshire communities is PAYT. This system requires households to pay for waste disposal based on the actual amount of waste they put out for disposal. The fee that is assessed for each bag or can of waste, or each pound of trash, provides an incentive for households to generate less waste, reuse what they can, compost certain organics, and recycle what remains. For most households, the amount of waste that can't be reduced, reused, recycled, or composted is a minor portion of the original total waste volume.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): In some communities, PAYT works on a per-container basis, requiring residents to purchase either a specific type of bag or stickers to place on their own bags. A few communities bill their residents based on the weight of their trash. Recyclables are accepted for free in unlimited amounts.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order):* Because solid waste management is handled at the local level, PAYT is established through local ordinances.
    b. *Resources Required:* The price of the bag can be set at a rate that pays for any additional cost, but the savings due to increased recycling usually makes this a cost savings practice.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Municipalities meet with resistance from some residents, who do not want to be "charged" for disposing of their trash. The residents need to understand that they are already paying for solid waste disposal in their property taxes (the statewide average is $242 annually), and there will be a savings in taxes that will offset the fee for the bags, unless they don't recycle or they have a very large family. Additionally, there is sometimes the concern that illegal dumping will occur, but this has not proved to be a significant problem in implementing towns.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)
    a. *Parties Responsible for Implementation*: Municipalities would need to pass ordinances to implement the program. Currently, 47 New Hampshire municipalities have adopted PAYT.
    b. *Parties Paying for Implementation*: Although these are municipal programs, towns can expect PAYT to result in cost savings.
    c. *Parties Benefiting from Implementation*: New Hampshire communities with PAYT programs have reported average reductions in waste amounts ranging from 25 to 35 per cent. Municipalities and residents can expect a corresponding decrease in their solid waste disposal costs.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Solid waste is often the third or fourth highest line item in town budgets, so the cost savings are important.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. Existing: The New Hampshire Legislature has consistently endorsed recycling as a method to reserve the state's disposal capacity.
    b. Proposed:

6. Timeframe for Implementation: Municipalities need to follow their own procedures for adopting ordinances.

7. Anticipated Timeframe of Outcome: The recycling rate will begin to increase as soon as the ordinances become effective.

Program Evaluation

1. Estimated CO_2 Emission Reductions – ANALYSIS UNDERWAY
    a. Short-term (2012):
    b. Mid-term (2025):
    c. Long-term (2050):

2. Economic Effects
    a. Costs
        i. Implementation Costs: Moderately low
        ii. Timing: Immediate / higher initial costs
        iii. Impacts: Business – medium
    b. Savings
        i. Potential Economic Benefits: Moderate
        ii. Timing: Constant / even
        iii. Impacts: Evenly Distributed

3. Other Benefits/Impacts
    a. *Environmental*: Landfilling solid waste results in leachate that must be treated prior to discharge and may result in the release of methane, a potent greenhouse gas, into the atmosphere. Similarly, there is concern about emissions from the incineration of solid waste.
    b. *Health*: It is not unusual for people living near landfills to complain about negative health effects from the odors. Leachate that escapes from a landfill can also impact surface and groundwater sources of drinking water.
    c. *Social*: There is significant resistance to new and expanded landfills and incinerators due to concerns about diminishing property values and health impacts. PAYT also institutes an equitable system that requires residents to only pay for their own trash and not subsidize the costs for their neighbors who don't recycle or use more than their fair share of disposal services.
    d. *Economic*: There can be significant job growth from the recycling industry.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: There are no technical barriers to implementation.
    b. *Economic*: Because PAYT has been shown to result in cost savings, there is significant economic benefit to implementation.
    c. *Statutory/Regulatory*:

d. *Social*: The opposition to PAYT is minor in comparison to concerns about property values, health impacts and odors. Illegal dumping has not been a problem for most communities.

5. Other Factors of Note:

6. Level of Group Interest: high

7. References:

- NHDES brochure, "Pay As You Throw: A Community Solution For The Rising Costs Of Solid Waste Disposal."

AFW Action 4.1 - Strengthen Local Food Systems

Summary

Stronger local food networks should be promoted and developed within the state. Food processing, packaging, storage, refrigeration, transportation, and marketing consume the vast majority of the energy used in the food industry. Food transported from the larger food producing centers can travel more than 20 times the distance of locally grown produce. Development of a stronger local food network can reduce the carbon emissions associated with distant food production, and may also insulate the state from disruptions in the food supply in the event that energy supply or transportation is threatened. These objectives would be accomplished by raising public awareness of the benefits and availability of locally grown and produced foods. New Hampshire could assist by developing and supporting marketing channels and programs, similar to the *fair trade* concept, to harvest the needed price premiums from local and regional markets for local and regional producers.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result)*

   Only a small fraction of food consumed in the state is currently produced here. Today, the state's farmers produce enough milk to supply nearly 100 percent of the state's fluid milk consumption but not enough for other dairy products (cheese, yogurt, butter, ice cream, etc.). Production of apples and maple syrup is nearly in balance with quantities consumed. Vegetables, small fruits, and herbs are produced in quantities that supply a significant but undetermined portion of the state's needs during the growing season. All of these products may be sold across state borders, however. Regionally (within New England or the Northeast), food production fills more diverse needs.

   Agriculture in New Hampshire has suffered from competition from foods produced more cheaply in other regions and other countries. Local farm businesses can thrive and supply significantly larger portions of the state's food requirements if consumers are willing to accept the often higher prices of locally produced foods. These higher prices reflect the true nutritional values and generally greater production costs of foods grown on New Hampshire's smaller and medium-sized farms. Increasing the farmers' and growers' share of the consumer food dollar is essential to achieving this goal.

   Support for this goal will also result in better utilization of available land resources. Strengthening local food systems and building a more prosperous agricultural economy will help prevent conversion of land for development by keeping more land in profitable agricultural production.

   Local food systems can be strengthened by:

   - Raising public awareness of the benefits and availability of locally grown and produced foods.
   - Developing and supporting marketing channels and programs, like the *fair trade* concept, that can harvest the needed price premiums from local and regional markets for local and regional producers.
   - Fostering growth of marketing connections between farmers and food producers and food consumers and buyers at all level – household, institutional, restaurant and hospitality industry, etc.
   - Supporting development of local agricultural and food processing and marketing enterprises and infrastructure in all regions of the state.
   - Encouraging development of urban agriculture, including community gardens. Preventing loss of farms and encouraging new farming enterprises in the more developed or developing communities and regions of the state.
   - Recognizing the role of agriculture and farming in the economy of more rural parts of the state, and supporting market development.

- Improving opportunities for new farmers and encouraging and educating new professionals and the workforce to provide the necessary services and support for strong local food systems.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order)*: Public education and outreach; market development; increase state support for agricultural education at all levels; establish state meat inspection program and support development of meat processing and other food and agriculture support industries and services.
    b. *Resources Required*
    c. *Barriers to Address (especially for medium to low feasibility actions)*: New Hampshire lacks infrastructure for processing food, which would increase shelf life. Lack of slaughter facilities and meat processing and inspection is a barrier to access to local meats. Municipal zoning and other regulations often create barriers and/or add burdensome costs for farms or other food producers. Fuel costs are a barrier, as well as higher feed, fertilizer, etc. costs in New England. High cost of land is a barrier to new start-up farmers and intergenerational transfer of family farm businesses.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.): Every person who eats in New Hampshire. All residents, visitors; farm businesses and agricultural suppliers and service-providers as well as local processors, distributors and marketers of local foods; every community in the state.
    a. *Parties Responsible for Implementation*: Cooperative extension and extension agents, and the New Hampshire Department of Agriculture, Markets & Food, Farmers Markets, as well as individual farms and farmers.
    b. *Parties Paying for Implementation*: Everybody will have to pay.
    c. *Parties Benefiting from Implementation*: Everybody will benefit.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing*:
    b. *Proposed*: AFW Action 1.1.1 – Increase Cover Crops
       AFW Action 1.1.2 – Increase Conservation Tillage/No-Till Farming Practices
       AFW Action 1.1.3 – Protect Agricultural Land

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate, continuous, and cumulative impacts.

<u>Program Evaluation</u>

1. Estimated CO_2 Emission Reductions
    a. Short-term (2012): <0.01 MMTCO2e/year
    b. Mid-term (2025): <0.01 MMTCO2e/year
    c. Long-term (2050): <0.01 MMTCO2e/year

2. Economic Effects
    a. Costs
        i. Implementation Cost: Low
        ii. Timing: Constant / even
        iii. Impacted: State government

b. Savings

i. Potential Economic Benefits: Moderately low
ii. Timing: Constant / even
iii. Impacted: Business – small

3. Other Benefits/Impacts

a. *Environmental*: Strengthening local food systems and building a more prosperous agricultural economy will help prevent conversion of land for development by keeping more land in agricultural production. In addition to carbon savings, this will preserve and protect varied wildlife habitats, protect ground and surface water quality, and more. Food produced and sold locally generally uses much less packaging as well as reduces transportation.

b. *Health*: New Hampshire farmers produce the healthy foods that are cornerstones of a varied, healthy diet: milk and dairy products, fruits and vegetables, lean meats, etc. No high-fructose corn sweeteners or partially hydrogenated (high in trans-fats) oils are produced locally. Fresher, local foods taste better and children and adults are more likely to eat more of these nutritionally valuable foods. Agricultural education programs at all grade levels will encourage more outdoor activity and exposure to nature. Community and school gardens combine the health benefits of improved nutrition and increased outdoor activity.

c. *Social*: Communities, families and individuals benefit from rediscovering and reconnecting with their agricultural heritage. Farmers markets and Community Supported Agriculture (CSA or membership) farms strengthen community ties and involve people of all ages in agricultural activities. The economic benefits for communities of supporting local farms and other businesses are immense.

d. *Educational*: Increased emphasis on local food systems and the values contributed by local foods and farms will help educate residents of all ages and education levels about where food comes from and how it is produced, and what the environmental and social impacts are. Increasing agricultural education opportunities will make more young people aware of opportunities in food and agriculture and related fields.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

a. *Technical*:

b. *Economic*: While there may be a greater cost associated with local food products, the dollars spent on New Hampshire agricultural products stay in New Hampshire and strengthen the entire community and increase economic stability.

c. *Statutory/Regulatory*:

d. *Social*: Local foods, whether CSAs or Farmers' Markets have become increasingly popular in the recent past and will likely receive greater support as questions concerning food safety and higher food costs remain.

5. Other Factors of Note:

A 2005 report from FoodShare, in Toronto, titled "Fighting Global Warming at the Farmers Market" compared eight items available at a farmers market during November to the same eight items at a supermarket down the street. The locally grown food from the farmers' market traveled an average of 63 miles compared to 3,353 miles for the supermarket foods. Carrots from California, for example, traveled 59 times further than carrots from Hamilton, Ontario. (New Hampshire is even farther from California than Toronto.) When comparing the carbon emissions from transporting these same foods, the local foods generated about 119 grams of carbon compared to 11,887 grams for the imported foods. In just one example, a lamb chop from New Zealand not only traveled 193 times farther than a lamb chop produced at a farm in Ontario, it generated more than 1,000 times the carbon because it was flown to the store in which it was sold.

Looking at the total carbon emissions associated with local food and imported food, the differences become even clearer. The entire CO_2 emissions created by transporting the local food is less than the CO_2 emissions for any single imported product except the New Jersey mixed baby salad greens. As a result, the CO2 emissions caused by transporting food locally is 0.118 kg, while the emissions caused by importing those exact same foods is 11kg. Over the course of a year, if you were to buy only locally produced food, the associated CO2 emissions would be .006316 metric tons. If instead you were to buy only imported foods like those studied here, the associated CO2 emissions would be .573 metric tons. This means that if you switched from eating all imported food to eating only locally produced food, you would already be half way towards achieving Canada's one metric ton challenge.

While Canada spends considerable sums on food imports, economic necessity is forcing many Canadian agricultural producers to quit farming as a full-time vocation. Between 1996 and 2001, the number of Canadian farms in operation decreased by eleven percent. Among those farmers who remain in business, net farm income continues to fall as a percentage of total income. Thus, farmers are becoming increasingly dependent on work from other industries to earn a livelihood. While opponents of the Kyoto Protocol often argue that ratification will cost jobs, they often fail to mention the jobs that will be created as we make the transition to a more environmentally sustainable economy.

Mechanisms that promote urban food production and direct marketing strategies such as farmers' markets and community supported agriculture (CSA) programs can go along way. Further research into season extension strategies could also lessen the impact of global warming by facilitating the development of a local, sustainable food system that operates for much the year.

6. Level of Group Interest: High

7. References: